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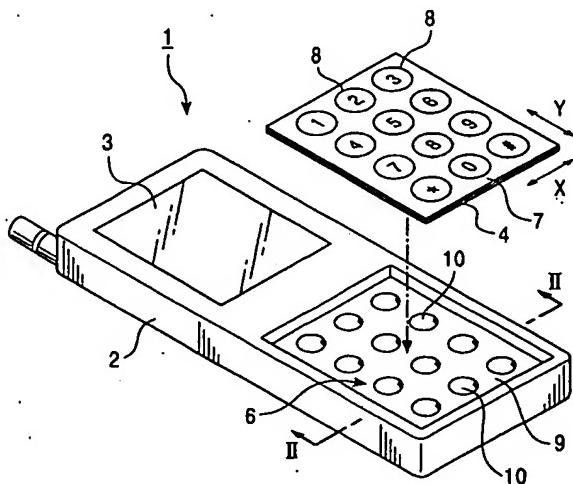
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(54) Input apparatus for performing input operation corresponding to indication marks and coordinate input operation on the same operational plane

(57) An input apparatus includes a flat input device of a pressure-sensitive type or a capacitive type, and an indicator sheet on which indication marks are formed is fixed on the surface of the flat input device. A tactile-feel-generating unit is provided behind the flat input device. The tactile-feel-generating unit includes dome-

shaped inversion plates which are disposed at positions corresponding to the indication marks. When one of the indication marks is pressed, an operation signal is generated in accordance with an item represented by the indication mark, and a tactile feel is generated by a reaction force of the corresponding inversion plate.

FIG. 1



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Description**BACKGROUND OF THE INVENTION****1. Field of the Invention**

[0001] The present invention relates to an input apparatus for performing an input operation in which input positions shown by indication marks are selectively touched and a coordinate input operation on the same operational plane.

2. Description of the Related Art

[0002] Input apparatuses for mobile phones or the like are provided with an push-button-type input unit used for various operations, for example, for inputting telephone numbers, connecting/disconnecting lines, etc.

[0003] Recently, mobile phones have been commonly used for establishing connections to the Internet, and various kinds of services have been provided via mobile phones. Accordingly, various kinds of menus are shown on displays of mobile phones and operations of selecting from such menus are frequently performed.

[0004] In order to select an item from a menu, input apparatuses of the known art are provided with a push-type or stick-type input unit for inputting directions in addition to the above-described push-button-type input unit. The push-type or the stick-type input unit is used for moving a mark indicating an item selected from a menu.

[0005] However, in input apparatuses of the known art, since the input unit for selecting an item from a menu is provided separately from the push-button-type input unit, there is a problem in that operability is degraded. In addition, since the direction in which the mark indicating the selected item is moved on a menu is limited to the vertical direction and the horizontal direction, it is difficult to quickly select an item from a menu. In addition, it is impossible to input hand-written characters by using the above-described input unit.

SUMMARY OF THE INVENTION

[0006] In order to overcome the above-described problems, an object of the present invention is to provide an input apparatus in which an operation of pushing a predetermined input position, moving a cursor for selecting an item from a menu, and inputting hand-written characters can be performed without degrading the operability of the input apparatus.

[0007] In addition, another object of the present invention is to provide an input apparatus in which an operator reliably recognizes that he or she has pushed an indication mark.

[0008] According to the present invention, an input apparatus includes an input unit with which a coordinate input operation is performed and which includes indica-

tion marks which indicate a plurality of input positions, and a control unit which receives an input signal from the input unit and generates an operation signal in accordance with the input signal, wherein the control unit recognizes the input signal obtained from the input means as coordinate data, and when one of the indication marks is touched individually, the control unit generates an operation signal corresponding to an item indicated at the corresponding input position.

[0009] The input unit may include, for example, a flat input device with which the coordinate input operation is performed and the indication marks formed on the surface of the flat input device.

[0010] When a position of contact on the input unit moves, the control unit recognizes the movement of the position of contact as coordinate data.

[0011] In addition, according to the present invention, an input apparatus includes an input unit which is flat and with which a coordinate input operation is performed, indication marks which are formed on the surface of the input unit and which indicate a plurality of input positions, and a control unit which receives an input signal from the input unit and generates an operation signal in accordance with the input signal, wherein,

[0012] when a predetermined input mode is set, the control unit detects that one of the input positions is touched and generates an operation signal corresponding to an item indicated at the corresponding input position, and when another input mode is set, the control unit recognizes the input signal obtained from the input unit as coordinate data irrespective of items indicated at the input positions.

[0013] The above-described input apparatus of the present invention may also include a display unit. When the control unit recognizes the coordinate data, the display means shows a display according to the coordinate data, and when one of the indication marks is touched, the display means shows a character, a symbol, or a number corresponding to the touched indication mark.

[0014] Preferably, the input apparatus further includes a tactile-feel-generating unit which generates a reaction force when one of the indication marks is pushed.

[0015] The tactile-feel-generating unit may include multiple tactile-feel-generating members which are disposed at positions corresponding to the indication marks, or be formed of a single tactile-feel-generating member disposed behind the input unit.

[0016] The tactile-feel-generating members may be formed of dome-shaped inversion plates placed behind the input unit.

[0017] Accordingly, the operator reliably recognizes

that he or she has pushed the indication mark, so that input failure due to insufficient pressing force can be prevented and the input operation can be reliably performed.

[0018] In addition, the inversion plates may also serve to generate a switch input.

[0019] In such a case, since the switch input is not generated until one of the inversion plates is inverted, input operation does not occur by merely touching the indication marks.

[0020] According to the present invention, both an operation for generating an operation signal corresponding to the input positions and an operation for generating coordinate data are performed on the same operational plane. Accordingly, the operability is not degraded and input operations can be performed quickly.

[0021] In addition, since the reaction force generated when one of the indication marks are pushed is transmitted to the operator, the operator reliably recognizes that he or she has pushed the indication mark. Accordingly, operational mistakes can be reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022]

Fig. 1 is an exploded perspective view of an input apparatus according to a first embodiment of the present invention;

Figs. 2A and 2B are sectional views of Fig. 1 cut along line II-II, wherein Fig. 2A shows a state in which the input apparatus is not operated and Fig. 2B shows a state in which the input apparatus is being operated;

Fig. 3 is a sectional view similar to Fig. 2A in which projecting members are provided as indication marks;

Fig. 4 is a functional block diagram of the input apparatus;

Fig. 5 is a flowchart of an input-mode switching process;

Figs. 6A and 6B are perspective views showing examples of input operations;

Fig. 7 is a sectional view showing another example of a tactile-feel-generating unit;

Fig. 8 is an exploded perspective view of an input apparatus according to a second embodiment of the present invention; and

Figs. 9A and 9B are sectional views of Fig. 8 cut along line IX-IX, wherein Fig. 9A shows a state in which the input apparatus is not operated and Fig. 9B shows a state in which the input apparatus is being operated.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0023] Fig. 1 is an exploded perspective view of an

input apparatus according to a first embodiment of the present invention. Figs. 2A and 2B are sectional views of Fig. 1 cut along line II-II, wherein Fig. 2A shows a state in which the input apparatus is not operated and Fig. 2B shows a state in which the input apparatus is being operated. Fig. 4 is a functional block diagram of the input apparatus according to the present invention, and Fig. 5 is a flowchart of an input-mode switching process. Figs. 6A and 6B are perspective views showing examples of input operations.

[0024] In an input apparatus 1 shown in Fig. 1, which is formed as a mobile phone, a display panel 3 which serves as a display unit and an input unit are mounted on a housing 2. The display panel 3 is formed of a monochrome or color liquid crystal panel or of an electroluminescent (EL) panel.

[0025] The input unit includes a flat input device 4. The flat input device 4 is of a capacitive type or a pressure-sensitive type, and a coordinate can be input by using the flat input device 4. When the flat input device 4 is of the capacitive type, an X-direction detection electrode and a Y-direction detection electrode, both of which are formed of Ag (silver) paste, are disposed such that they oppose each other in a matrix pattern with a resin sheet therebetween. The resin sheet is formed of, for example, polyethylene terephthalate (PET) which is insulative and has a predetermined dielectric constant. The flat input device 4 is constructed such that it can be bent by disposing resin sheet and the electrodes on a substrate on which a conductive pattern is formed. Accordingly, when a dielectric member, for example, a finger, touches the surface of the flat input device 4, a coordinate can be input.

[0026] Alternatively, when the flat input device 4 is of the pressure-sensitive type, a resistor having a potential difference in the X and Y directions and a conductor are disposed such that they oppose each other. When the flat input device 4 is pushed by, for example, a finger, the conductor and the resistor come into contact with each other, causing a change in resistance. In this way, a coordinate is input.

[0027] In addition, the input apparatus 1 also includes a indicator sheet 7 which is laminated and fixed on the surface of the capacitive type or the pressure-sensitive type flat input device 4 (see Figs. 1, 2A, and 2B). The indicator sheet 7 is formed of a resin such as PET, a silicone rubber, etc., and indication marks 8 are formed on the surface of the indicator sheet 7 by printing or transferring so as to indicate input positions corresponding to a plurality of characters, numbers, symbols, etc. The indication marks 8 are provided with circular lines which define the input positions, and characters, numbers, symbols, etc., are formed inside the circular lines by printing or transferring.

[0028] The indicator sheet 7 may be formed in a shape having concavities and convexities such that regions at which the indication marks 8 are disposed protrude upward. Alternatively, as shown in Fig. 3, project-

ing members 8A formed of rubber or the like may be attached onto the surface of the indicator sheet 7, and characters, numbers, symbols, etc., may be formed on the surface of the projecting members 8A by printing or transferring.

[0029] A tactile-feel-generating unit 6 is disposed behind the flat input device 4. The tactile-feel-generating unit 6 includes a base 9 which is formed of a glass-epoxy resin or a metal and disposed inside the housing 2 and dome-shaped (diaphragm-like) inversion plates 10 which are arranged on the base 9. The inversion plates 10 are placed at positions corresponding to the indication marks 8.

[0030] In a state shown in Figs. 2A and 3, which is a state in which the input apparatus 1 is not operated, neither the flat input device 4 nor the indicator sheet 7 is deformed. In addition, the dome-like shapes of the inversion plates 10 are maintained. In this state, when a desired indication mark 8 is pushed from above by a finger, a pen, or the like, both the flat input device 4 and the indicator sheet 7 are deformed and are bent inward, as shown in Fig. 2B. Accordingly, the corresponding inversion plate 10 is inverted by the pushing force, so that a reaction force is produced by the inversion plate 10. This reaction force is transmitted to the operator's finger as a tactile feel, so that the operator reliably recognizes that he or she has pushed the indication mark 8.

[0031] As shown in Fig. 4, the input apparatus 1 includes a control unit 21, and the display panel 3 and the flat input device 4 are connected to and controlled by the control unit 21. In addition, a transmitting unit 22, a receiving unit 23, and a memory unit 24 are also connected to the control unit 21. The transmitting unit 22 and the receiving unit 23 are used for communicating sound signals and data signals with the external environment, and the memory unit 24 is used for storing phone-number data, various set data, and data to be displayed on the display panel 3, etc.

[0032] The control unit 21 is able to set two different types of input modes: a predetermined input mode (an indication-mark input mode) which is selected when input positions shown by the indication marks 8 are pushed individually by a finger or the like and the other input mode, which is a coordinate input mode. When, for example, one of the indication marks 8 is pushed for a predetermined time interval, it is determined that the predetermined input mode (indication-mark input mode) is set. In this mode, an input signal corresponding to an item represented by the indication mark 8 is generated, and an operation signal corresponding to a character, a number, or a symbol is generated on the basis of the input signal.

[0033] In addition, when the position at which a finger or the like touches the flat input device 4 is moved before the predetermined time interval elapses, it is determined that the other input mode (coordinate input mode) is set. In this case, coordinate data corresponding to the movement of the finger on the surface of the flat input device

4 is generated, and an operation signal is generated on the basis of the coordinate data.

[0034] When the predetermined input mode is set, numbers, etc., are shown on the display panel 3, as shown in Fig. 6A. Fig. 6A shows a state in which a finger or the like has touched the indication mark 8 representing the number '6', so that a display 3a showing the number '6' appears on the display panel 3.

[0035] When the other input mode is set, as a finger or the like touching the flat input device 4 moves, a display 3b showing a locus of the finger or the like appears on the display panel 3, as shown in Fig. 6B. In addition, when, for example, it is recognized that the locus represents a certain character (for example, the letter 'Z'), that character (Z) appears on the display panel 3.

[0036] Alternatively, when the operator starts to move his or her finger on the flat input device 4, the display panel 3 may show a menu from which the operator is able to select or a cursor which can be moved by the operator. For example, when a homepage (a web page) of the Internet is displayed on the display panel 3, a cursor may be shown on the display panel 3 such that it can be moved freely in various directions in an X-Y plane in accordance with an input operation on the flat input device 4.

[0037] When the cursor is moved to a position of an item to be selected from the menu, a determination operation is subsequently carried out. The determination operation may be executed by, for example, softly hitting (tapping) the surface of the flat input device 4 or by using an operating member provided on the housing 2 separately from the flat input device 4.

[0038] The operation of pushing one of the indication marks 8 and the above-described tapping operation are distinguished from each other on the basis of a difference between the states of input detection of the flat input device 4. For example, when the flat input device 4 is of the capacitive type, the pushing operation and the tapping operation are distinguished on the basis of a difference between changes in the capacity per unit of time. In addition, when the flat input device 4 is of the pressure-sensitive type, the pushing operation and the tapping operation are distinguished on the basis of a difference between changes in the resistance per unit of time.

[0039] In the input apparatus 1, the control unit 21 switches between the above-described predetermined input mode (indication-mark input mode) and the other input mode (coordinate input mode) by using software programs. Accordingly, input modes are automatically switched and the display panel 3 shows a display corresponding to the selected input mode.

[0040] A process performed at the control unit 21 of the input apparatus 1 will be described below.

[0041] As shown in Fig. 5, at Step 1 (ST1), it is determined whether or not the predetermined input mode, that is, the input mode corresponding to the indication marks 8, is set. When it is determined that the predetermined input mode is set, that is, when the result at ST1

is Yes, the process proceeds to ST2 and the display panel 3 shows a screen corresponding to the items represented by the indication marks 8. Then, the process proceeds to ST3, and when one of the indication marks 8 of the flat input device 4 is pushed, an input signal corresponding to the item represented by the pushed indication mark 8 is generated. Then, at ST4, an operation signal is generated on the basis of the input signal and the display panel 3 shows an updated screen in which the generated operation signal is reflected.

[0041] When the control unit 21 determines that the other input mode is set, that is, when the result at ST1 is No, the process proceeds to ST5 and the display panel 3 shows a screen corresponding to the coordinate data, for example, a display including a selection menu or a cursor. Then, the process proceeds to ST6, and when the flat input device 4 is operated, an input signal which is irrespective of the items represented by the indication marks 8 is generated by the flat input device 4. Then, the process proceeds to ST7, and the above-described input signal is recognized as the coordinate data and the display panel 3 shows an updated screen in which the coordinate data is reflected.

[0042] The control unit 21 switches between the predetermined mode and the other mode by determining whether a finger or the like touches one of the input positions shown by the indication marks 8 for a predetermined time interval or the finger or the like moves before the predetermined time interval elapses. However, the predetermined mode and the other mode may also be switched manually by an input operation.

[0043] Although it is described above that the inversion plates 10 formed of dome-shaped metal plates are provided in the input apparatus 1 for generating a tactile feel for the operator, they may also be used for generating a switch input when they are inverted.

[0044] Fig. 7 shows an inversion plate which is constructed as a switching element 11 which is able to generate a switch input.

[0045] As shown in Fig. 7, the switching element 11 includes an electrode 13a and a conductive pattern 13b which are formed of Ag paste at both sides of a resin sheet 12 formed of PET. The electrode 13a and the conductive pattern 13b are formed on the resin sheet 12 by printing, etc.

[0046] The electrode 13a is formed at the top side of the resin sheet 12, and includes a circular electrode 13a1 formed at the center thereof and an annular electrode 13a2 formed around the circular electrode 13a1 with a predetermined gap therebetween. A conductive pattern is formed continuously from a part of the electrode 13a2. The conductive pattern 13b is formed at the bottom side of the resin sheet 12 and is connected to the electrode 13a1. More specifically, a through hole is formed in the resin sheet 12 at a position under the electrode 13a1, and a connecting conductor 14 which electrically connects the conductive pattern 13b and the electrode 13a1 is formed inside the through hole. In ad-

dition, a dome-shaped (diaphragm-like) inversion plate 15 is formed at the upper side of the electrode 13a2 such that the inversion plate 15 is in contact with the electrode 13a2 at the periphery thereof and the top point of the inversion plate 15 is positioned directly above the electrode 13a1.

[0047] A resist film 16a is disposed at the periphery of the inversion plate 15, and another resist film 16b is disposed under the conductive pattern 13b. A resin sheet 17 formed of PET is laminated so as to cover the entire surface of the switching element 11, and the resist film 16b is bonded to a metal base 18 with an adhesive layer 19, whereby the switching element 11 is constructed.

[0048] Switching elements constructed as described above are installed under the flat input device 4 in place of the inversion plates 10 shown in Figs. 2A and 2B. When the flat input device 4 is pushed from above by a finger, both the flat input device 4 and the indicator sheet 7 are deformed and the corresponding inversion plate 15 is pushed downward by the pushing force. Accordingly, the inversion plate 15 is inverted as shown by the dotted chain lines in Fig. 7, so that the inversion plate 15 comes into contact with the electrode 13a1. As a result, the electrode 13a and the conductive pattern 13b are electrically connected to each other, so that a switch output is changed to ON. When, for example, the switch output is turned ON, the coordinate input signal generated by the flat input device 4 is ignored and only the input from the switching element 11 is recognized by the control unit 21. In addition, when the inversion plate 15 is inverted, the reaction force generated by the inversion plate 15 is transmitted to the operator's finger as a tactile feel. On the contrary, when the switching element 11 is not operated, the input operation of the flat input device 4 is recognized by the control unit 21.

[0049] In addition, the above-described switches provided for each indication mark 8 may be connected to a single switch circuit, and the switch circuit may be constructed such that the output therefrom is set to ON when any one of the switches is pushed. In such a case, when the output from the switch circuit is turned ON, detection signals of the flat input device 4 may be ignored, that is, the mode in which only the switch input of the indication marks 8 is recognized may be selected.

[0050] Next, an input apparatus according to a second embodiment of the present invention will be described below with reference to Figs. 8, 9A, and 9B. Fig. 8 is an exploded perspective view of the input apparatus, and Figs. 9A and 9B are sectional views of Fig. 8 cut along line IX-IX, wherein Fig. 9A shows a state in which the input apparatus is not operated and Fig. 9B shows a state in which the input apparatus is being operated.

[0051] In an input apparatus 30 shown in Fig. 8, which is formed as a mobile phone, a display panel 3 which serves as a display unit and an input unit are mounted on a housing 2. This input apparatus 30 includes a flat

input device 31 which is different from that of the above-described input apparatus 1. Other constructions of the input apparatus 30 are similar those of the above-described input apparatus 1, and explanations thereof are thus omitted.

[0052] The flat input device 31 is of a pressure-sensitive type or a capacitive type, and an X-direction detection electrode and a Y-direction detection electrode are disposed such that they oppose each other in a matrix pattern with a resin sheet formed of polyethylene terephthalate (PET) therebetween. The resin sheet provided with the above-described electrodes are disposed on a rigid substrate formed of a glass-epoxy resin or a metal. In addition, a indicator sheet 7 which is formed similarly to the first embodiment is laminated and fixed on the surface of the flat input device 31 at the front side and a tactile-feel-generating unit 33 is disposed behind the flat input device 31.

[0053] The tactile-feel-generating unit 33 includes a projection 35 formed such that an end thereof is moveable in the vertical direction. The projection 35 is formed behind the flat input device 31 at the center of a base 36 formed as a recess in the housing 2, and is constructed such that a tactile feel is generated by a reaction force or the like when the projection 35 is pushed from above. The tactile-feel-generating unit 33 may also be formed of the above-described dome-shaped inversion plate.

[0054] A pantograph 34 is disposed between the flat input device 31 and the base 36 as an elevation unit.

[0055] As shown in Fig. 8, the flat input device 31 is supported by the pantograph 34 such that the flat input device 31 is able to move in the vertical direction.

[0056] In the state shown in Fig. 9A, that is, in a state in which the operation is not performed, the pantograph 34 is slightly stretched upward so that the flat input apparatus 31 and the indicator sheet 7 are positioned at the upper end. At this time, the flat input device 31 may be raised by the elastic force applied from the protrusion 35 or by an electric member (not shown), such as a coil spring, provided on the base 36.

[0057] When the flat input device 31 is pushed from above by a finger or the like, the pantograph 34 collapses and the flat input device 31 and the indicator sheet 7 are evenly pressed downward. As a result, a reaction force generated when the projection 35 is pushed is transmitted to the operator as a tactile feel, so that the operator reliably recognizes that he or she has pressed the flat input device 31.

[0058] Similarly to the input apparatus 1, the input apparatus 30 includes a control unit which switches between the predetermined input mode and the other input mode. The process of switching between the predetermined input mode and the other input mode is the same as the above-described process.

[0059] The input apparatus of the present invention is not limited to a mobile phone. For example, the input apparatus of the present invention may also be constructed such that the predetermined input mode is used

for controlling a television set and the other input mode is used for controlling a game device.

5 Claims

1. An input apparatus comprising:

10 input means with which a coordinate input operation is performed and which includes indication marks which indicate a plurality of input positions; and
15 a control unit which receives an input signal from the input means and generates an operation signal in accordance with the input signal,

20 wherein the control unit recognizes the input signal obtained from the input means as coordinate data, and when one of the indication marks is touched individually, the control unit generates an operation signal corresponding to an item indicated at the corresponding input position.

25 2. An input apparatus according to Claim 1, wherein the input means comprises a flat input device with which the coordinate input operation is performed and the indication marks formed on the surface of the flat input device.

30 3. An input apparatus according to Claim 1 or 2, wherein when a position of contact on the input means moves, the control unit recognizes the movement of the position of contact as coordinate data.

4. An input apparatus comprising:

35 40 input means which is flat and with which a coordinate input operation is performed;
45 indication marks which are formed on the surface of the input means and which indicate a plurality of input positions; and
a control unit which receives an input signal from the input means and generates an operation signal in accordance with the input signal,

50 55 wherein, when a predetermined input mode is set, the control unit detects that one of the input positions is touched and generates an operation signal corresponding to an item indicated at the corresponding input position, and when another input mode is set, the control unit recognizes the input signal obtained from the input means as coordinate data irrespective of items indicated at the input positions.

5. An input apparatus according to any of Claims 1 to 4 further comprising display means, wherein when

the control unit recognizes the coordinate data, the display means shows a display according to the coordinate data, and when one of the indication marks is touched, the display means shows a character, a symbol, or a number corresponding to the touched indication mark. 5

6. An input apparatus according to any of Claims 1 to 5 further comprising tactile-feel-generating means which generates a reaction force when one of the indication marks is pushed. 10
7. An input apparatus according to Claim 6, wherein the tactile-feel-generating means includes tactile-feel-generating members which are disposed at positions corresponding to the indication marks. 15
8. An input apparatus according to Claim 6, wherein the tactile-feel-generating means includes a single tactile-feel-generating member disposed behind the input means. 20
9. An input apparatus according to Claim 7 or 8, wherein the tactile-feel-generating members are formed of dome-shaped inversion plates placed behind the input means. 25
10. An input apparatus according to Claim 8, wherein the inversion plates serve to generate a switch input. 30

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FIG. 1

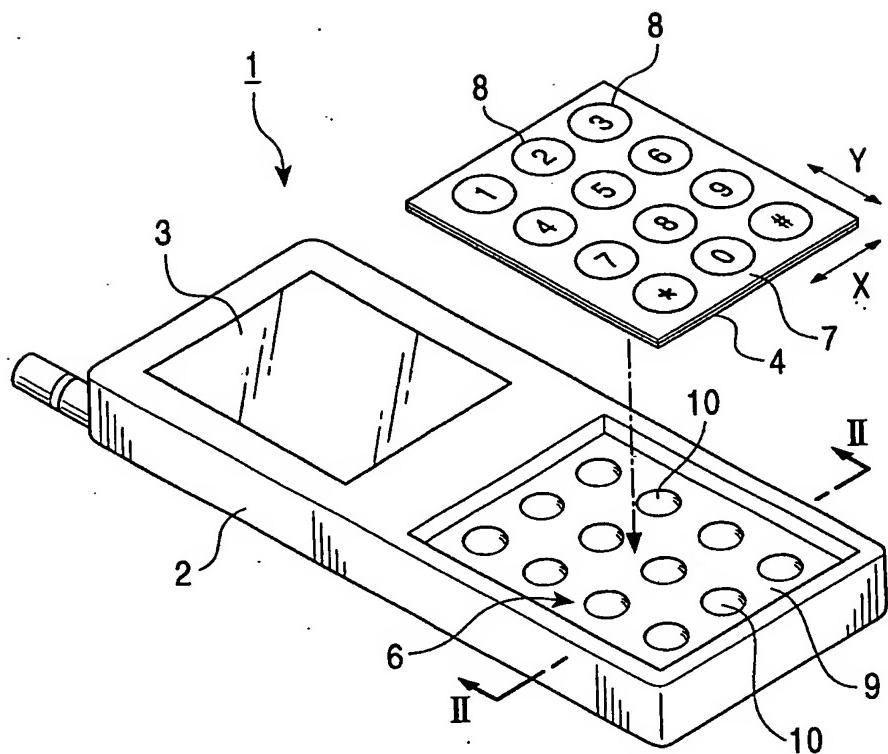


FIG. 2A

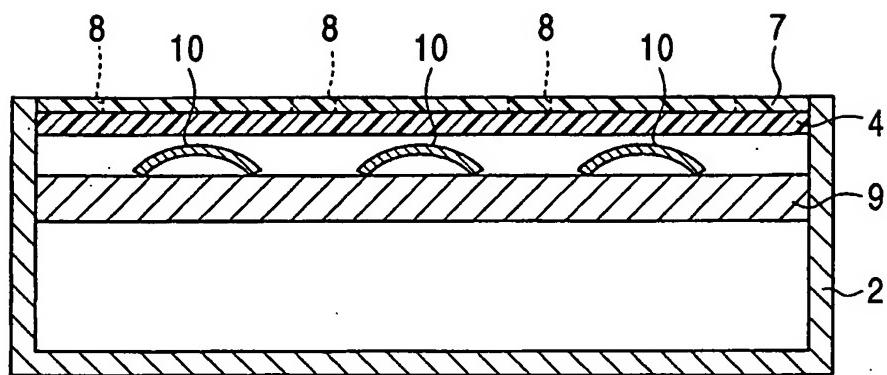


FIG. 2B

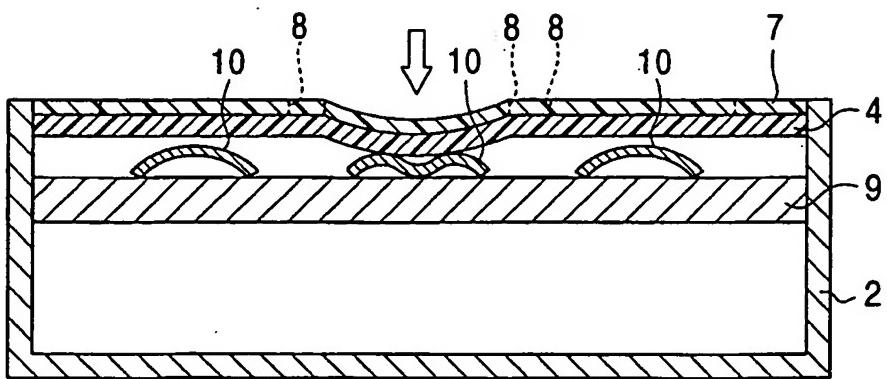


FIG. 3

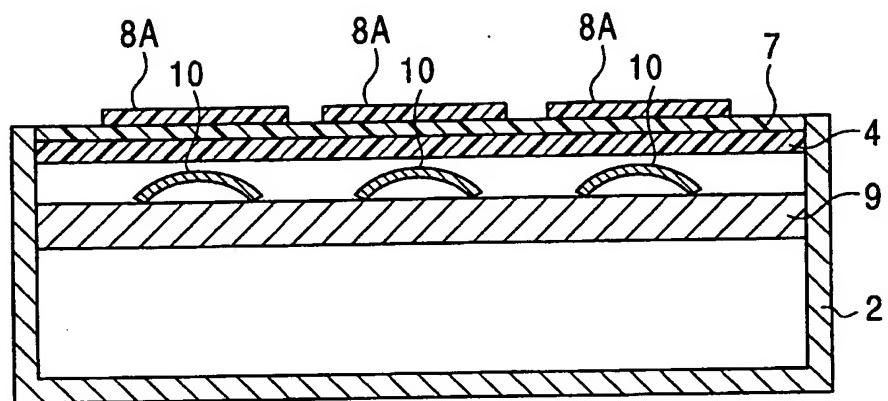


FIG. 4

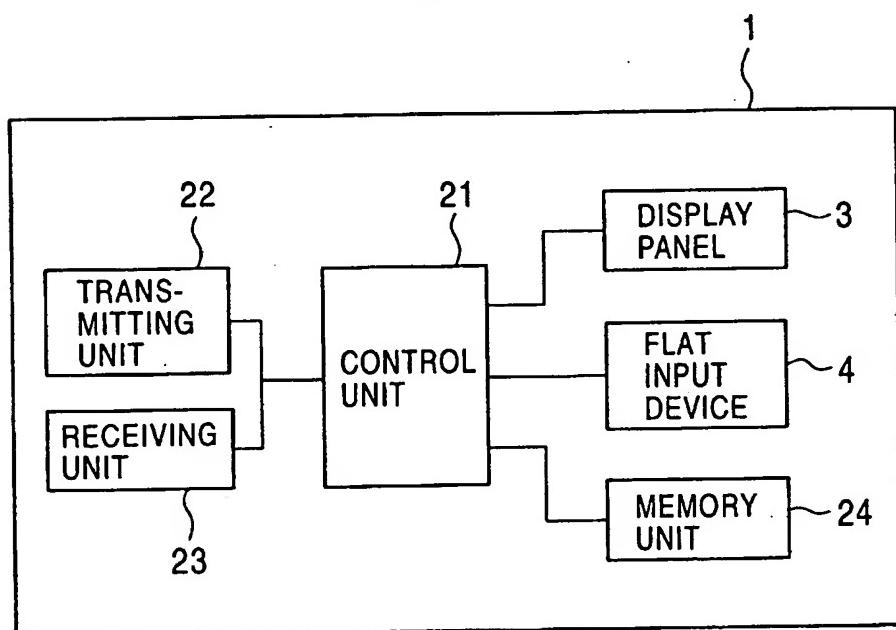


FIG. 5

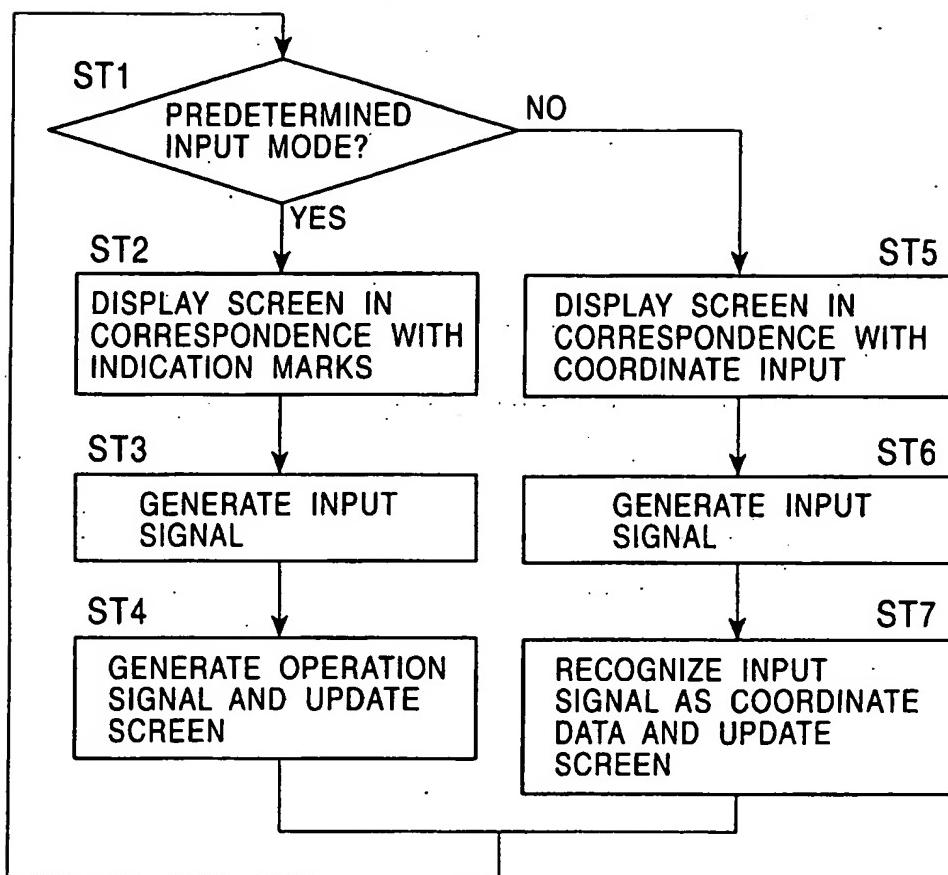


FIG. 6A

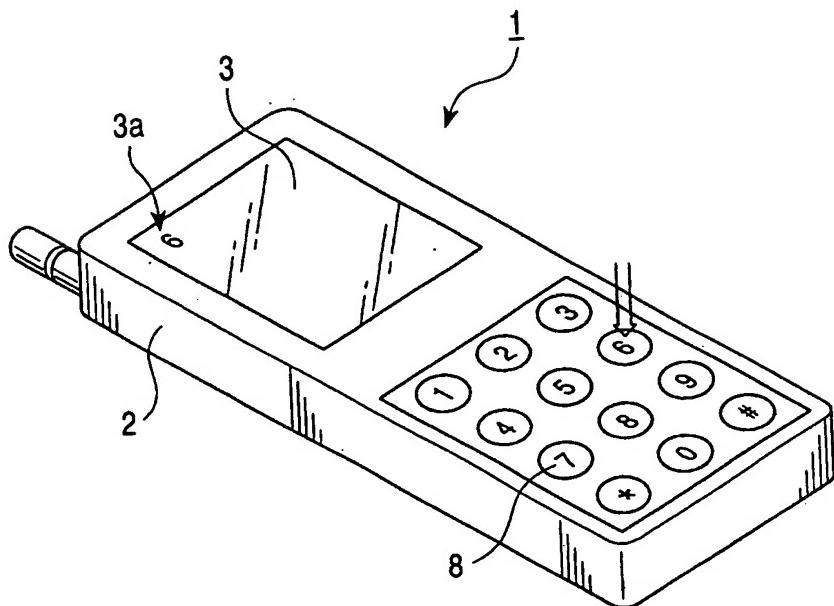


FIG. 6B

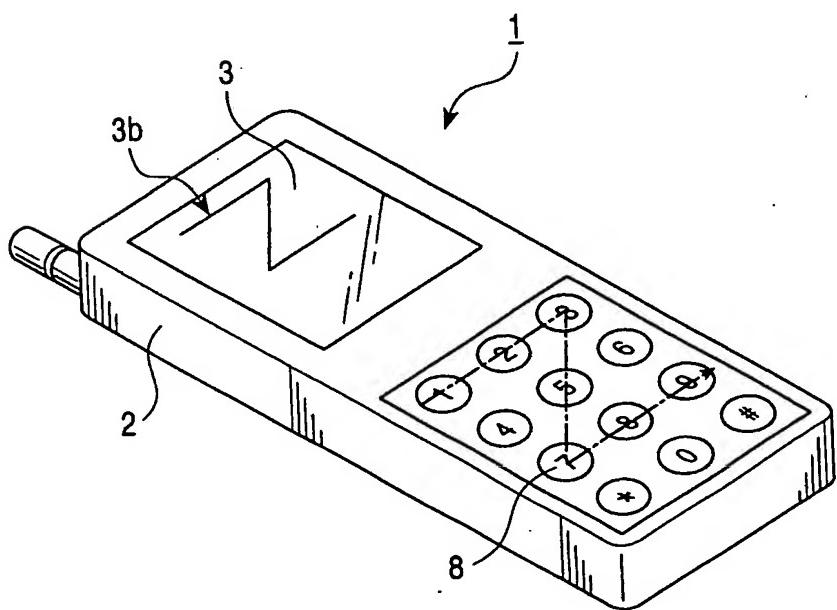


FIG. 7

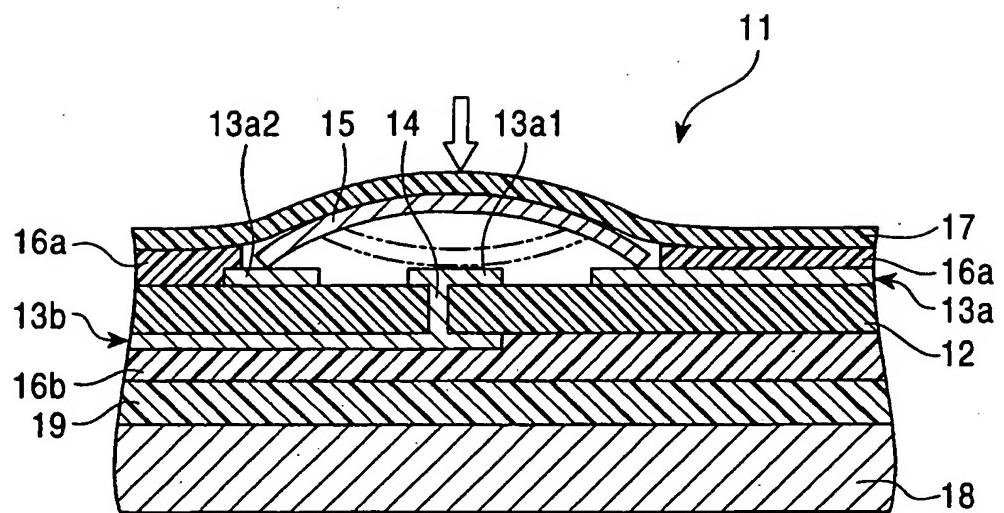


FIG. 8

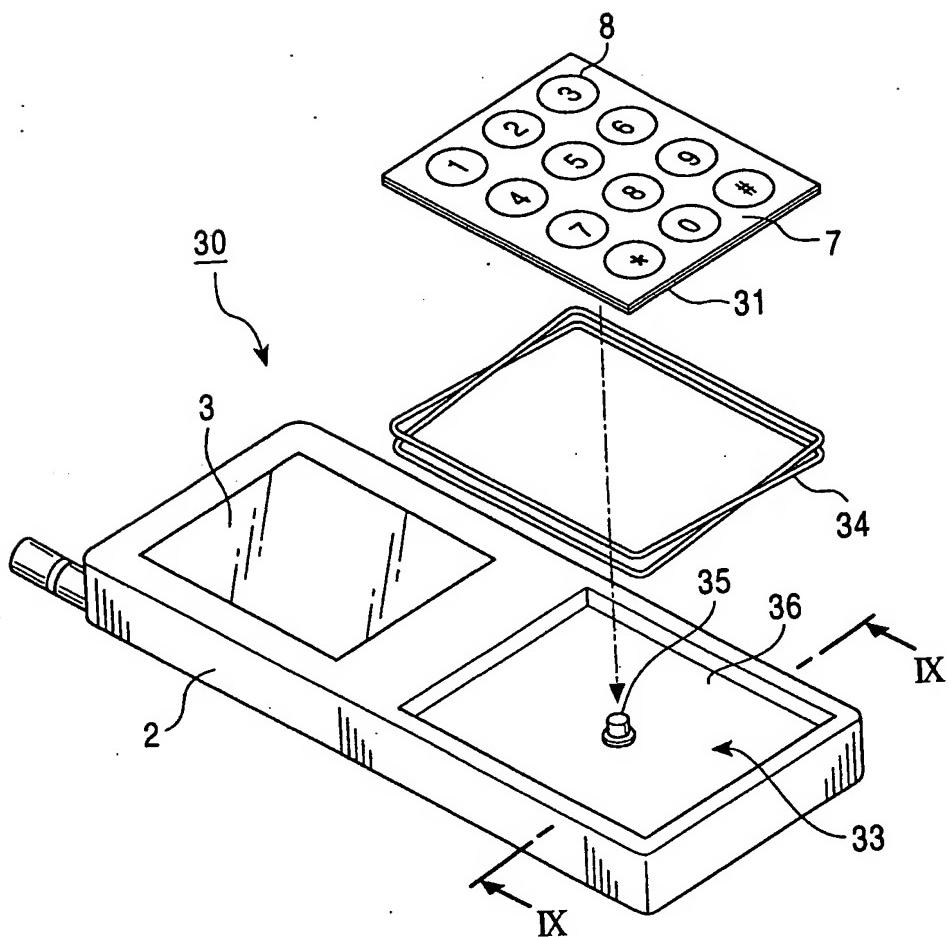


FIG. 9A

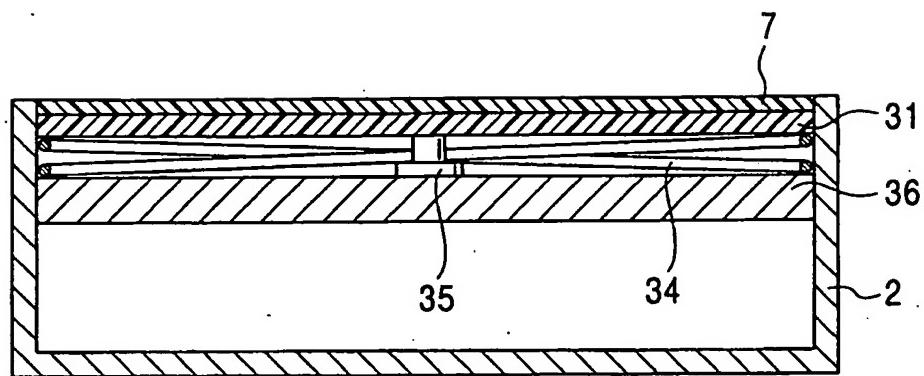
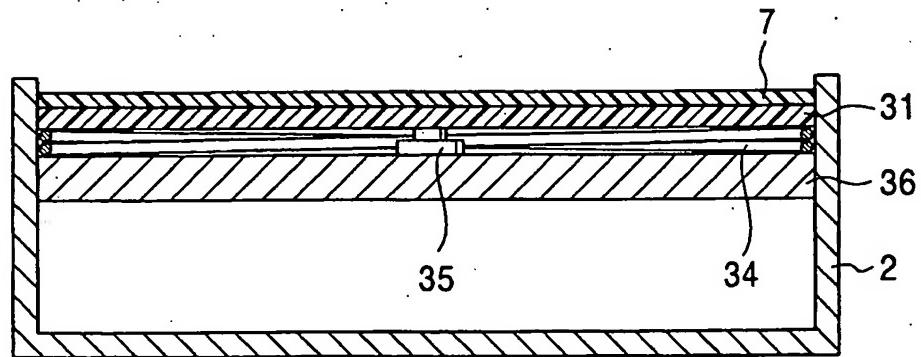


FIG. 9B





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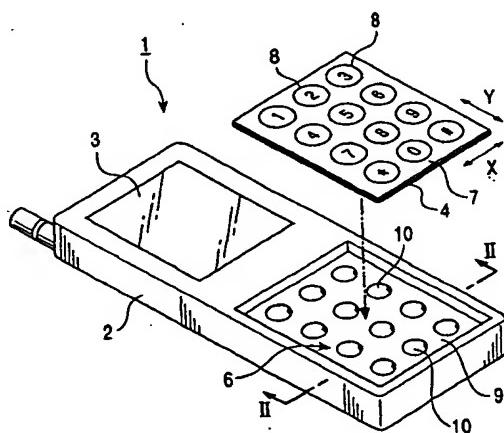
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(54) Input apparatus for performing input operation corresponding to indication marks and coordinate input operation on the same operational plane

(57) An input apparatus includes a flat input device of a pressure-sensitive type or a capacitive type, and an indicator sheet on which indication marks are formed is fixed on the surface of the flat input device. A tactile-feel-generating unit is provided behind the flat input device. The tactile-feel-generating unit includes dome-shaped inversion plates which are disposed at positions corresponding to the indication marks. When one of the indication marks is pressed, an operation signal is generated in accordance with an item represented by the indication mark, and a tactile feel is generated by a reaction force of the corresponding inversion plate.

FIG. 1



EP 1 286 250 A3



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